DRIVER ACCEPTANCE OF COMMERCIAL VEHICLE OPERATIONS (CVO) TECHNOLOGY IN THE MOTOR CARRIER ENVIRONMENT

EXECUTIVE SUMMARY

Critical Issues Relating To Acceptance of Technology By Interstate Truck and Bus Drivers

US Department
of Transportation

**Federal Highway
Administration**

INTELLIGENT TRANSPORTATION SYSTEMS/COMMERCIAL VEHICLE OPERATIONS

US Department of Transportation

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Introduction

Penn + Schoen Associates has been commissioned by the Federal Highway Administration to conduct a study entitled "User Acceptance of Commercial Vehicle Operations (CVO) Services." The purpose of this study is to identify and evaluate critical issues relating to user acceptance of CVO services by interstate truck and bus drivers and to identify the CVO information needs of other interested parties.

This study consists of two distinct tasks. Task A, which is based on document reviews and a series of 50 in-depth interviews, fulfilled four primary objectives: 1) identified those issues relating to CVO services that are of potential impact or concern to interstate truck and bus drivers; 2) identified the information needs of other interested parties outside the U.S. Department of Transportation; 3) identified areas/topics that may deserve higher-level analysis during task B; 4) collect other information that will aid in the finalization of the workplan for Task B. The report of Task A findings has already been submitted to the Federal Highway Administration and is entitled "Identification of Concerns and Needs: Final Report of Findings From Document Reviews and In-Depth Industry Executive Interviews."

Task B is the subject of this report.

EXECUTIVE SUMMARY

This study of CVO Services shows that on the whole, Commercial Vehicle drivers are receptive to and supportive of the use of CVO services on the road and in their vehicles. Technologies which received the most support were those that would "make my work easier," are "useful for me" and "will work [in my vehicle] / I would rely on it."

However, there was some concern that certain of the technologies would be an invasion of driver privacy by either the government or the driver's company, and also a concern that the systems would rely too much on computers and diminish the role of human judgment. Drivers were wary of services that promised too much and would leave them dependent on unproven, inexperienced technology. They wanted systems that would be reliable, workable, and useful on a consistent basis, and would not pose a threat to themselves, their vehicles, their privacy, or their livelihood.

On the whole, drivers tended to evaluate the CVO services from the perspective of their personal experience, rather than focusing on the bigger picture of the industry as whole. For example, independent owner operators, who have historically been more skeptical of technology and wary of intrusion by the government or companies, reacted more negatively toward the technologies than did other drivers. Therefore, when reviewing the results of this study it is important to pay particular attention to the analysis of subgroups, because their personal experience as a driver shaped their view of the technologies. In particular, there was significant differences between the following groups:

- Union vs. Non-union drivers
- Company drivers vs. Independent owner operators
- Younger vs. Older drivers
- Newer drivers vs. Drivers who have been driving for many years
- Truck drivers vs. Bus drivers

Driver acceptance of the installation of the technology in their vehicles is most closely linked with feelings that the technology is useful, reliable, and effective in making their jobs easier. Therefore, a primary focus of this study is to identify those drivers who stand to benefit the most from the technology, determine their initial reactions, and provide the government with actionable recommendations that they can use to make the drivers more favorable to CVO services.

The Executive Summary will seek to examine these issues and address important concerns relating to driver acceptance of CVO services.

<u>**OVERALL REACTIONS TO CVO SERVICES**</u>

A significant finding of the research is that truck and motorcoach drivers react very differently to CVO services.

Motorcoach opera tors generally view CVO technologies very favorably, with Commercial Fleet Management garnering the most positive reactions. At the other end of the spectrum is On Board Safety Monitoring, which was rated the least favorably by motorcoach operators. In the middle tier are Commercial Vehicle Electronic Clearance, Automated Roadside Safety Response, and Commercial Vehicle Administrative Processes, which were received favorably, but not as strongly as fleet management. Overall, motorcoach operators were favorably disposed to these technological services, and gave solid levels of support to the installation in these services in their vehicles.

Truck drivers, on the other hand, had mixed feelings* about *the technologies. Hazardous Material Incident Response was rated very highly by drivers, In the middle tier we found positive reactions to Commercial Fleet Management and Commercial Vehicle Electronic Clearance. However, many truck drivers had negative reactions to three of the technologies: Commercial Vehicle Administrative Processes, Automated Roadside Safety Response, and On Board Safety Monitoring, which again was viewed least favorably.

What follows is an index summarizing the level of driver support versus level of driver resistance for the installation of these 6 technologies in their vehicles:

Index Of Favorability To Installation In Drivers' Vehicles

Ratio of Percent Strongly in Favor to Percent Completely Opposed

CVO Service	Truck Drivers	Motorcoach Operators
HMIR	7.9 to 1	NIA
CFM	3.1 to 1	6.1 to 1
CVEC	2 to 1	3.3 to 1
ARSI	1.2 to 1	4.7 to 1
CVAP	1 to 1	3.8 to 1
OBSM	.70 to 1	2to 1

The index shows the higher levels of support among motorcoach operators than among trucks drivers. Also evident is the extreme variation in

reaction to the services within the population of truck drivers, ranging from very favorable reactions to HMIR to a mix of positive and strongly negative feelings about the lower tier technologies.

REACTIONS TO CVO SERVICES BY SEGMENT

Far from having monolithic opinions about CVO Services, commercial vehicle operators showed significant *variation* by *sub-group* in their attitudes toward the technologies. For example, **truck drivers and** motorcoach **operators often react very differently to the services.**

Within these two populations, there are also important differences by segment. For example, among truck drivers, the following groups had significant differences of opinion about Commercial Fleet Management:

More supportive of CFM	More opposed to CFM
- Company drivers	- Independent owner operators
- Long haul drivers	- Short haul drivers
- Large fleet	- Small or medium fleet drivers
- New drivers	- Those who have been driving longer
- Drivers with new technology in their vehicles already	- Vehicles without technology

In fact, among 5 of the 6 technologies, important sub-group variation was seen among truck drivers in their reaction to the services.

Higher level analysis was conducted in order to isolate those segments of the population who are more or less favorable to the installation of CVO Services in their vehicles.

The entire sample was divided into three categories: "acceptors," "skeptics," or "rejecters":

- *Acceptors* are those who are favorable toward the implementation of all of the technologies to which they were exposed

- *Skeptics* were favorable to the implementation of at least one, but not all of the technologies

- *Rejecters* were favorable to the implementation of none of the technologies,

Overall, the sample broke down as follows:

- Acceptors	46% of sample
- Skeptics	*42%*
- Rejecters	12%

Cluster and cross-tabular analysis point to certain segments of the industry that are more likely to accept the technologies. In' particular, looking at the entire sample and all the technologies together, it was determined that the members of the following groups are more likely to be "acceptors" of these CVO technologies:

- Motorcoach operators
- Less experienced drivers
- Lower income
- Spend more than half an hour per day at weigh stations, inspection sites, or filling out paperwork

Among truck drivers, the following additional groups are also more likely to be favorable to the installation of the technologies:

- Union drivers
- Company or private fleet drivers
- Drivers in large fleets
- Paid by the mile

Among motorcoach operators, the following additional groups are more likely to be favorable to the technologies:

- CB radio in motorcoach
- Drive predominantly in the South
- Charter drivers
- Daily route varies

The significant differentiation by segment does not mean, however, that no common patterns of driver acceptance of CVO technologies were seen. On the contrary, the research suggests that across the different technologies, drivers acceptance was based on very similar reasons.

FACTORS LEADING TO ACCEPTANCE OF CVO SERVICES

Higher level multiple regression and factor analysis were conducted to determine which factors were most associated with acceptance of CVO services. Although the different services elicited varied responses from drivers, higher level analysis was able to distill **common themes that are associated with driver acceptance of the services overall.**

The characteristic which underlies positive feelingstoward the technologies overall is makes my *work easier.* In other words, **drivers were most likely to be positively disposed toward the technologies if they felt that it would make their work easier.**

Driver acceptance of the installation of technology in their vehicles is most closely linked with feelings that the technologies are useful, effective, and reliable. Benefits such as increasing driver independence, reducing paperwork, reducing traffic and congestion, increasing safety, and helping comply with regulations are on the whole less important to driver acceptance than the general feeling that the technologies are *useful for me* and *will work / I would rely on it.*

Thus the three most important attributes in making drivers favorable to and accepting of CVO services are:

- makes *my work easier*
- *will work/l would rely on it*
- *useful for me*

These findings are supported by the results of interviews conducted with participants in l-75 or HELP/Crescent operational tests. These respondents rated the technologies that they tested significantly higher than the rest of the population in terms of being *"useful* for me" and *"will work.4 would rely on it."*

Variation between technologies does exist, but nevertheless, the overall **most effective way to frame the technologies** in order to produce driver acceptance would be **in terms of the persona/ benefits enumerated above.**

On the other hand, the idea that these technologies are intrusive and are in fact an "invasion of privacy" was seen to be highly correlated to driver *rejection* of the technologies. The two attributes most likely to produce driver rejection of the technologies are:

- *invasion of my privacy by company*
- *invasion of my privacy by government*

Typically, it is independent owner operators and drivers who have been driving for a long time who are most worried about government and company intrusion and supervision.

Also highly associated with this fear of intrusion is the feeling that the technology "relies *too much on computers/loss of human judgment."*

Looking at verbatim comments from drivers who are opposed to CVO services as well as the ratings drivers gave the technologies, one gets the sense that **drivers react negatively to the technologies when they feel they would represent a threat of some kind.** Some drivers worry that certain technologies would allow enforcement personnel or company representatives to monitor and penalize them; some others, for example, worry that their record keeping would be closely scrutinized and that they would be disciplined for minor infractions.

Thus, producing driver acceptance of CVO services could be most effective/y accomplished by showing drivers that the technologies will make drivers work easier, and generally be useful and reliable, while finding a way to minimize the feeling that the technology will lead to increased control over them or an invasion of driver privacy by either the drivers 'company or the government.

These findings suggest that it is may not be necessary to develop widely different approaches for marketing different technologies as **great uniformity was seen across the technologies in terms of what attributes are most closely related to driver acceptance of the technologies.** On the other hand, targeting problematic sub-groups of the population who are more resistant to these technologies would most likely be beneficial in securing broad based support their introduction into the industry.

OPERATIONAL TEST PARTICIPANTS

From the interviews conducted with drivers who had participated in operational tests of the technologies, it emerged that **actual experience working with CVO technologies will likely** lead **to greater driver acceptance.**

While the small number of interviews conducted with operational test participants means that these results are qualitative in nature, nevertheless

participants were much more favorable toward Commercial Vehicle Electronic Clearance and Automated Roadside Safety Inspection than were drivers overall.

In particular, drivers who have engaged in operational tests were more likely to say that the technologies were *useful for me* and will *work / I would rely on* it and less likely to say they would cause an invasion *of privacy by the government* -- three factors which our higher level analysis, showed were crucial to increasing driver acceptance of technologies.

Thus, this data suggests that placing technologies directly in the hands of users themselves, and allowing them to experience and experiment with the CVO services, would likely be an effective way to increase driver acceptance of the technologies and reduce driver fears and concerns about them.

IMPLICATIONS

The success of the operational tests suggests a possible role for the federal government in increasing the acceptance of CVO services. If the intent of the government is to foster the acceptance of these technologies, there is a real opportunity to help to do that by giving drivers an opportunity to experience the technologies first hand. **Thus, supporting pilot programs that allow drivers to use the technologies would likely bring long term benefits in terms of increasing driver acceptance.**

Further, the research highlights the value of **specifically targeting subgroups of the population** which are more wary than average of the technologies. Trial programs could be designed that would be specifically tailored to the concerns of target groups. Such programs could be very valuable if they were able to **allow drivers to experience the technologies in an unthreatening environment.**

SUMMARY OF REACTIONS TO CVO SERVICES

Reactions to CVO services varied widely, with some such as Hazardous Materials Incident Response and Commercial Fleet Management garnering very positive ratings from a significant majority of respondents, while others such as On Board Safety Monitoring were perceived to have liabilities by many respondents.

What follows is a brief discussion of drivers reactions to each technology and an examination of what they perceived as the benefits and drawbacks of each.

Commercial Fleet Management (CFM)

Compared to the other **CVO** Services tested, Commercial Fleet Management was very well received by respondents. Looking at the ratio of those who are strongly in favor of the technology versus those who are completely opposed, truck drivers favored this technology by a 3:I margin, and motorcoach operators by *6:* 1. **Motorcoach drivers were especially favorable to this service because of its usefulness and potential to increase safety.**

Unlike many technologies which were seen to have significant benefits as well as serious liabilities, CFM was not burdened by substantial drawbacks. Overall, it was seen as:

- **-** Useful
- **-** Easy to use
- **-** Helpful in complying with regulations
- - Reliable

Among truck drivers in favor in installation, the largest percentage said they were in favor of the improved communications with their dispatcher.

Motorcoach operators also found fleet management to be among the most useful of all the services tested.

Those opposed to installation of Commercial Fleet Management in their vehicle viewed it as an invasion of their privacy and as relying too much on computers.

Automated Roadside Safety Inspection (ARSI)

Similar to other technologies, ARSI was received more favorably by motorcoach rather than truck drivers. Among truck drivers, the ratio of those strongly in favor of installation to those completely opposed was approximately 1 :1, while it was nearly 5:1 among motorcoach operators. **Both truck and motorcoach drivers reported that automated roadside safety inspection service would he/p improve safety and reduce traffic at the station, but compared to the other five CVO services tested, truck drivers were not particularly favorable towards automated roadside safety inspection.**

The most frequently cited reason why truck drivers opposed the technology was because they felt that computers could not accurately inspect their truck, it was an invasion of privacy, and there would be too much government involvement.

On the other hand, those truck drivers in favor of using automated roadside safety inspection service said they were favorable because it of its benefits including:

- Save time
- Improve safety

Drivers who were engaged in I-75 or HELP/Crescent operational tests rated this service significantly higher than did the overall sample on the following attributes:

- *useful for me*
- *will work/I would rely on it*
- *would give me an advantage over other drivers*

These respondents were also significantly less likely to say that the technology exhibits weaknesses such as relying too much on computers or being an invasion of privacy by the government. Operational test participants were also significantly more likely to favor installation of ARSI in their vehicles.

Overall, motorcoach drivers were more favorable towards automated roadside safety inspection service than truck drivers. *A majority of motorcoach drivers thought that this technological service would bring safety benefits on the road, help reduce traffic at the station, and be useful for them.*

Although the majority of motorcoach drivers were favorably disposed toward this technology and thought it would bring them benefits, a number of them think that this technological service is an invasion of privacy by the government, and that it relies too much on computers.

Hazardous Materials Incident Response (HMIR)

Truck drivers were **extremely favorable towards hazardous material incident response service,** placing this technology in the top tier, above even Commercial Fleet Management. Respondents strongly favored installation by a margin of 8:1 over those strongly opposing it. By this measure and others, this

technology was the most popular tested among truck drivers [this service was not tested among motorcoach operators.

In particular, a majority of truck drivers felt that hazardous material incident response would:

> - Improve safety
> - Be useful to them
> - Work/they could rely on it
> - Make it easier to comply with regulations
> - Be easy to use

On the downside, approximately one in four respondents thought HMIR relied too much on computers and excluded human judgment.

On Board Safety Moniforing (OBSM)

Compared to the other CVO services tested, users were not particularly favorable towards on board safety monitoring. In fact, among both motorcoach and truck drivers, this was the least *popular* technology tested. **While a majority of respondents were still able to recognize the potential safety benefifs of this service, the idea that the technology was too invasive and too relianf on computers made many respondents unwilling to accept this service.**

Among truck drivers, safety is the greatest perceived benefit of on board safety monitoring service. *in fact, on board safety monitoring was rated higher than* any other *CVO* service -- except *for* hazardous *material incident response service -- for its ability to improve safety on the road.*

However, many respondents feared that on board safety monitoring service would be an invasion of their privacy by the government, relied too heavily on computers, or would be an invasion of drivers' privacy by their company. **In fact, among truck drivers, there are more drivers completely opposed to on board safety monitoring than drivers strongly in favor of it.**

Favorable impressions of OBSM seem to stem from driver perceptions that the system will monitor the cargo and the vehicle and improve safety. A number of strategies for mitigating driver opposition were suggested by the research. Many drivers felt that they would be more positive if the monitoring was not focused on the driver, but rather on the truck. Others also felt that the government should not be involved and that the information generated by the system should not go to enforcement personnel.

Although motorcoach operators also had mixed opinions of On Board Safety Monitoring, nevertheless the majority of motorcoach operators think this service would:

- Improve safety
- Be easy to use
- Make it easier to comply with regulations
- Be useful for them

Motorcoach operators strongly favored installation by a ratio of 2:I over those completely opposed. This level of support is, however, the lowest for any technology tested among motorcoach operators.

Commercial Vehicle Nectronic Clearance (CVEC)

Both truck drivers and motorcoach operators were favorable to CVEC. *Among truck drivers, we observed a 2:1 ratio of those strongly favoring installation of this service in their vehicles over those completely opposed,* placing this technology -- along with Commercial Fleet Management -- above CVAP, OBSM, and ARSI but below Hazardous Materials Incident Response in terms of level support for installation versus amount of resistance. *Motorcoach operators favored installation by a ratio of more than 3:1.*

Both motorcoach and truck drivers thought CVEC would have benefits such as its ability to reduce traffic at stations. Approximately 4 out of 5 truck drivers "strongly agreed" that CVEC would reduce traffic at weigh stations, and a majority felt it would make their work easier, be useful for them, and improve safety on the road. But many also feared that commercial vehicle electronic clearance would lead to an invasion of their privacy by the government and that it relied too heavily on computers.

Drivers who were engaged in I-75 or HELP/Crescent operational tests were more likely to find benefits in the technology such as being useful and reliable, and less likely to perceive it as an invasion of privacy. It is not surprising then that *these respondents were more likely than the overall population to favor having this service installed in their vehicle.*

Motorcoach operators were less inclined than truck drivers to say that commercial vehicle electronic clearance helps reduce traffic at the station, that it would make their work easier or be useful for them However, motorcoach operators were more likely than truck drivers to report that CVEC would make if easier to comply with existing regulations and help reduce paperwork.

Commercial Vehicle Administrative Processes (CVAP)

Commercial Vehicle Administrative Processes was among the least popular technologies with truck drivers, but was ranked higher among motorcoach operators.

Truck drivers were not particularly favorable towards commercial vehicle administrative processes, although approximately half the respondents agreed that CVAP would reduce paperwork and make it easier to comply with existing regulations. **in fact, among truck drivers, equal numbers completely opposed installation and strongly favored it.**

However, approximately half of respondents felt that this service would be an invasion of privacy by the government, and lesser but still significant numbers thought that the service relies too heavily on computers and would be an invasion of privacy by companies. Moreover, **fewer respondents than average felt that this service would be useful to them.**

Looking at the two separate components of the service, it is seen that truck drivers are somewhat more favorable to electronic purchase of credentials than automated mileage, fuel reporting or auditing.

in marked contrast to truck drivers, motorcoach drivers were very favorable towards commercial vehicle administrative processes. Overall, motorcoach operators supported installation by a ratio of 4:1. Many felt that it would **reduce paperwork, make it easier to comply with regulations, be useful and give them an advantage over other drivers.** A minority of respondents, however, felt that this service would be an invasion of privacy by companies or the government, and that it relies too much on computers.

METHODOLOGY

A total of 1582 interviews were conducted with interstate truck and motor coach drivers. All interviews were conducted from February 23, 1995 to April 21, 1995 and were distributed as follows:

- 1134 in-person interviews with truck drivers
- 411 in-person interviews with motorcoach drivers
- 37 telephone interviews with participants in operational tests

The following is a detailed breakdown of the surveys:

Truck Drivers

A total 1134 interviews were conducted with truck drivers intercepted at fifteen truck stops across the United States. These truck stops were randomly selected and quotas were kept using a stratified systematic sampling methodology (probability proportional to size) based on commercial truck diesel fuel consumption by state for 1992. At each site, specially trained Penn - Schoen staff, supervising and working in conjunction with local field teams, intercepted drivers and conducted in-person interviews, entering the data directly into portable computers to ensure accuracy of results.

Thirty seven interviews were conducted via telephone with truck drivers who had participated in CVO operational tests. An additional 38 truck drivers started the interview but did not qualify because they had not yet used the technology although it was installed in their vehicles.

Motorcoach Operators

A total of 411 in-person interviews were conducted with motorcoach drivers at seven sites across the United States. The intercept and interview procedure used for truck drivers was also employed for motorcoach operators, The interviews with motorcoach drivers were broken down as follows:

A total of 208 interviews were conducted with motorcoach drivers intercepted at line-run bus terminals in New York, New York and Los Angeles, CA. . 203 interviews were conducted with motorcoach drivers intercepted at popular tourist attractions, which were selected in consultation with the Department of Transportation Because interviews

with charter drivers were conducted during the colder winter months, sites were selected that tend to have more charter bus trips during this time of the year:

- Orlando, FL
- Washington, DC
- Los Angeles, CA
- Las Vegas, NV

The margin of error for the entire sample of 1582 interviews is +/-2.5% at the 95% confidence level. The margin of error for the sample of 1171 truck drivers is +/-2.9% and for the sample of 411 motorcoach drivers is +/-4.8%. An additional 37 interviews were conducted with drivers who have been involved in either the I-75 or HELP/Crescent operational tests. The margin of error for this group is +/-16.1%.

The following six CVO Services were tested among the respondents:

- *Commercial Fleet Management (CFM)*
- *Commercial Vehicle Electronic Clearance (CVEC)*
- *Commercial Vehicle Administrative Processes (CVAP)*
- *Automated Roadside Safety Inspection (ARSI)*
- *Hazardous Material Incident Response Service (**HMIR**)*
- *On Board Safety Monitoring (OBSM)*

Each respondent was questioned about three of these technologies (those drivers who haul Hazardous Materials were introduced to four). As specified by the FHWA all respondents received questions on Commercial Vehicle Electronic Clearance and Automated Roadside Safety Inspection, and the remaining technologies were rotated in. Only those drivers who haul Hazardous Materials received those questions on Hazardous Material Incident Response Service. This rotation was used to ensure that the length of each interview would not exceed a length of 15 minutes.

Each technological service was evaluated using a combination of open and closed-ended questions. The services were measured across a range of attributes:

- *useful for me*
- *improves safety on the road*
- *reduces traffic congestion [at the station -- where applicable]*
- *makes my work easier*

- *reduces paperwork*
- *would give me an advantage over other drivers*
- *invasion of my privacy by company*
- *invasion of my privacy by government*
- *makes it easier to comply with existing regulations*
- *makes me more independent*
- *relies too much on computers/loss of human judgment*
- *easy to use/won't require too much training*
- *will work/i would rely on it*

Definition of Terms Used in this Report

Charter Drivers: Motorcoach drivers who usually drive charter routes

Commercial Vehicle Drivers: Refers to the entire sample of respondents, including both truck and bus drivers

Company Drivers: Truck drivers who identified themselves as working for a company

Independents/Independent Owner Operators: Those drivers who identified themselves as independent owner\operators

Line Run Drivers: Motorcoach drivers who usually drive line-run routes

Haz Mat Drivers: Truck drivers who haul loads of hazardous materials, dangerous explosives, or petroleum. Drivers who answered questions on hazardous material incident response service.

Motor Coach Driver/Operator: Any respondent whose primary job is driving a motor coach. Interchangeable with bus drivers.

Operational Test Drivers: Any driver who participated in a CVO operational test such as Advantage I-75, Help/Crescent, etc.

Truck Drivers: Any respondent whose primary job is driving a truck.

Note to the reader: Throughout the report, there are many references to "government" without distinction of which level of government is being referred to. This is because respondents did not differentiate between the levels of government and often referred to government as one entity.